

FILE COPY FOREST INSECT LABORATORY,
STANFORD UNIVERSITY CALIFORNIA

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Insect Control-*Sierra*
San Joaquin Control
Project.

June 1, 1920.

WORKING PLAN

San Joaquin Insect Control
Project.

1920-1924.

Approved:

Date 6/25/20

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Date 6/24/20

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Date 7/3/20.

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16. 25

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WORKING PLANS
SAN JOAQUIN INSECT CONTROL PROJECT
1920-1924

PART 1--History.

Introduction.

A conservative, though well-based estimate, made in 1917 shows that during that year approximately 90 million feet of merchantable yellow pine and sugar pine were killed by bark beetles in District 5. This represents an actual stumpage value of about \$270,000.00. A careful study of the conditions makes it evident that this figure represents at least the average annual loss which has occurred during the seasons from 1912 to 1919. At present stumpage rates, timber owners have suffered an apparent loss, during this period, of 720 million feet of merchantable timber (pine) with a stumpage value of \$2,340,000.00. Approximately 49% of this loss (299 million feet or \$936,000.00) occurred on National Forest lands. During this same period District 5 has expended about \$60,000.00 from its fire funds in fighting insect epidemics.

In all cases in the past, Insect Control has been considered as an emergency matter and has been discontinued after the seriousness of the infestation has apparently subsided. The acreage worked has depended mainly upon the amount of available funds which, in many cases, were not sufficient to cover preliminary recommendations. The period of the control work has also been limited entirely to winter and spring months as the methods employed have not been considered feasible during the summer season.

The character of the results obtained from this work have varied on different projects. In many cases an evident reduction in the quantity of dying timber has followed the initial application of control measures, but on a number of projects these results have been only of a temporary nature.

The check of the epidemic which followed the control work may have been apparent for two or three years, but subsequently the infestation has increased and again decreased, following the fluctuations which are characteristic of bark beetle epidemics.

As a result of the apparent outcome of a number of control projects which have been carried out both by National Forests and private owners, there has been a tendency to question the efficacy of the methods of control that have been employed. It has been generally realized, however, that even though the methods themselves may be perfectly sound, the basis of their application has not been clearly defined. Two obvious reasons may be cited as contributing to the unsatisfactory results from various insect control projects:

1. The areas selected have not been extensive enough in acreage and have not been protected by barriers sufficient to prevent the infestation from coming in from the outside, thus nullifying in a few years the results of the control work.
2. A permanent policy of maintaining Insect Control has been lacking. Even where excellent results have been secured for a year or two after the application of control measures, no provision has been made for protecting these results either by checking new incipient epidemics within the control area, or by extending the work into adjoining infested timber. It has been felt for sometime that regular "follow up" work would eventually be necessary if the full benefits of the original control work were to be secured.

ASHLAND CONFERENCE INVESTIGATIONS.

Realizing that a more intensive investigation of the results to be obtained by the use of standard insect control methods would help to clear up a number of disputed points, the Bureau of Entomology through its field station at Ashland, Oregon, and the Forest Service organizations of District 5 and 6, in January 1917 planned to carry out a cooperative study under what is designated as "The Ashland Conference Plan." This plan involved a comprehensive study of the results of the percentage principle of control on

at least two demonstration areas. In order to limit the expense of this study these areas were specified to be small in extent and so far as possible to be completely isolated by type barriers from surrounding bodies of timber. The principle difficulty encountered has been to find suitable areas meeting these specifications. The first project recommended under this plan was located within the Sequoia National Forest and the Sequoia National Park, cooperation being obtained from the National Park for the project.

During the spring of 1918, approximately 50% of the over-wintering infestation within the watershed was treated. In a subsequent examination made in 1919 it was found that the total loss of 1918 had decreased from 1917 by about 72%.

In reviewing the results of this project the Ashland Conference has gone on record for extending investigations of this character to an area which would be more representative of commercial forest conditions. While the results from the Laweah area indicated that a pronounced decline in the amount of infestation may follow the removal of a relatively low percent of the infested timber, two objections may be raised to accepting these results;

1. The area, being small and isolated, is not representative of the conditions found in large bodies of commercial timber where protection is desired. The application of the methods used on this project will still have to be demonstrated on a large scale before we can expect their final acceptance.
2. No provision was made for continuing any further control work on the area so as to maintain and protect the results which have been obtained. This latter consideration was felt to be the more important of the two because when applied to extensive forest areas, it is patent that Insect Control, like Fire Protection, to be satisfactory must be carried out on a permanent basis of support.

SELECTION OF THE SAN JOAQUIN AREA

The specifications considered in the selection of a new area for extending these insect control investigations were the following:

1. Extensive enough to include all of the Yellow Pine, Sugar Pine type of a comprehensive forest region.
2. Stand representative of commercial timber both in extent and quality.
3. Accessible so as to permit of the easy administration of the control work.
4. Ownership, either Government or private, under such control as will assure permanent financial support to the project.
5. Infestation, either epidemic or endemic. If endemic, control work to be carried on so as to maintain this condition. If epidemic, control to be established and then maintained.

Within the distinct limits of the pine type in the Southern Sierra region may be found a number of fairly large but definitely bounded areas which meet the majority of these requirements. Several areas in both the Sequoia and Sierra National Forests were considered, but the San Joaquin Basin was finally agreed upon as the one best adapted to the several purposes of this project. The entire drainage of the basin, both North and South of the main river was originally recommended for the control area, with a check area for investigative purposes yet to be selected either in the Kings River or Kaweah watersheds. For administrative reasons and lack of funds it was thought best to confine the control work to that part of the area which lies north of the main river together with the Kaiser and Daulton Creek Basins. The territory includes the infestation units outlined in the 1917 Insect Survey as follows:

24, Hogue Ranch; 24-a Northfork, (see note); 25 Rock Creek; 26, Chiquite; 27, Jackass; 28, Daulton; 29, Sand and Whiskey; 30, Willow Creek.

N.B. 24-a, Northfork: Not included in 1917 survey because of very low quality of commercial timber.

The area left in the drainage south of the river consists of the following: 22, Stevenson Creek; 22-a, Jose Basin; 23, Big Creek. It has been decided to hold this part of the area at present for special investigative purposes and for study as a check against the control work.

The total acreage and stand are:

Total acreage, pine type . . . 164,000

Total stand:

Yellow Pine 1,464,000 M.B.M.

Sugar Pine 749,500 " " "

This area includes all of the pine timber within the San Joaquin drainage. The western and eastern boundaries of this belt are formed by complete and absolute barriers in type. The north-western and southern are arbitrary, being defined only by drainage as the type belt extends both north and south of the area. The canyon of the San Joaquin divides the area into northern and southern parts, separated by a distinct type break in the lower drainage.

The territory north of the canyon barrier, which includes 120,000 acres, about 85% of the entire area, with a stand of 1,307,500 M.B.M. yellow pine and 682,500 M.B.M. sugar pine will be covered by control work in 1920. The check area south of the river contains 24,000 acres with a stand of 166,500 M.B.M. of yellow pine and 67,500 sugar pine.

An outline of the distribution of the pine type and boundaries of units is shown on map attached to this memorandum.

CHARACTER OF INFESTATION

The primary infestation on this area has consisted of *D. brevicornis* in Yellow Pine and *D. Monticolae* in Sugar Pine. The loss caused by these two species occurs mainly in large-sized, mature trees. Occasionally pole stands are killed by combined attacks of one of more species of *Ips* and *D. brevicornis*. In the mixed stands of this type epidemics have not developed the severe character which marks the *D. monticolae* infestations in pure stands of the northwest, where 30 to 50 percent of the timber may be killed in an epidemic lasting for 5 or 6 years. The infestations of the Sierra region are marked by sustained annual losses in mature timber. Fluctuations in this annual loss may be classed as epidemic cycles, covering periods of 3 or 4 years. At the highest point these epidemics seldom kill more than 25% of the total stand in any one season, and in years of light infestation, less than 1/2 of 1% of the stand.

However, even this light amount of loss occurs in stands which are not fully stocked, and the fact that the timber which is killed represents just so much board measure lost to future markets, makes it possible to compute the actual value of the loss in timber resources. This fact apparently is well appreciated by the White and Friant Lumber Company, the largest private owners in the region.

PAST LOSSES

Complete seasonal losses on this area have been determined, for one year only. The 1917 survey estimated the annual loss for that year as 2,198,000 feet in yellow pine and 2,605,000 in sugar pine, a loss of about \$15,000.00. Due to the fact that considerable control work has been carried out on the area as well as to natural causes, the loss has been subject to considerable annual fluctuation and an estimate of the actual loss for each season, aside from 1917, cannot be safely arrived at. It is believed, however, that the total loss for the period including the seasons from 1912 to 1919 can be conservatively estimated at 4 million annually or 32 million for the period, a loss in value of about \$104,000.00.

Definite figures for the entire amount of the 1919 loss will be compiled from cruising records before the close of this season's work. From preliminary cruising, however, it is evident that the seasonal loss for this year was marked by a rather heavy killing of trees during the summer season and a marked decline in the amount of fall and over-wintering infestation.

PREVIOUS CONTROL WORK

Control work carried out on portions of the area during the seasons of 1913, 14, 15 and 17 by the Forest Service:

Year:	Units Treated	Acreage:	Amt. Expended	Bd. Ft. treated.
1913:	24, 24a, 22a	40,000	2,000.00	500,000
1914:	24a, 24, 30, 22, 22a, 26	20,400	4,482.50	1,295,000
1915:	26	11,640	2,434.43	463,060
1916:		:	:	:
1917:	25, 26	16,520	3,403.00	755,000
Totals:			\$12,319.93	2,911,000

In addition to the work carried on by the Forest Service, the White and Friant Lumber Company has expended in unit 29, approximately \$12,000.00 in insect control on its own lands.

RESULTS OF PAST CONTROL WORK

Definite comparisons or conclusions as to the results of this work for the entire area cannot be drawn with the data at present available. The course of the infestation in the Chiquito Basin and Stevenson Creek, which have been checked very closely, has shown a decline following the initial application of control, but a more or less steady recovery toward the original condition. On the other hand, Hogue Ranch and Rock Creek units, apparently sustained but very little if any increase in loss since the first control work was completed in 1914 and 1917. The heaviest loss encountered in the 1920 control work has been found on the Daulton Unit, where no control work has been carried on in the past, while the Chiquito Basin shows a marked improvement by comparison. The influence of past control work will be made a feature of the investigative program in 1920, and if warranted a special report prepared.

On the whole, however, it must be conceded that the policy of applying control methods only as an emergency matter to well-developed epidemics and on small areas, is not providing the protection desired.

The purpose of the San Joaquin project is to demonstrate that epidemic losses can be not only controlled, but prevented, if a permanent policy of protection work is carried out on a large enough area.

PART II.

Present Plans.

The plan of attack outlined by the Ashland Conference involved two distinct phases of the control.

SPRING WORK ON OVER-WINTERING INFESTATION

General cleaning up of the entire area to reduce epidemics to an endemic or normal condition. The methods are those which have been in common use. The period lasts from the first of March to the latter part of May. Infested trees are located, marked, felled, peeled,

and infested bark burned, about 50 to 80% of the infestation being removed from the area actually worked. If results are successful, but one year's application of this method will be necessary.

SUMMER OR MAINTENANCE WORK

The plan proposed by this method is practically new in practice although it is suggested by Dr. Hopkins in Bulletin 83 under the topics, "How to Control a Limited Attack" and "How to Maintain Control", on (page 32). The use of trap tree during the summer months to maintain control is proposed in some detail on page 48 of the same publication.

In applying this method it is proposed to maintain a permanent insect patrol of the entire area, the detail of which will be explained in the following paragraphs. The period of work will correspond to the fire season and the insect control work will become an actual phase of the plan for fire protection. The method of treating infested trees involves discontinuance of the use of fire where conditions are hazardous. Trap trees will also be used as a means of attracting the infestation to accessible points for treatment. It is proposed to continue this system for a period of 5 seasons, in order to obtain an adequate basis for comparison of costs and results with the former system of periodic control projects which has been carried out on the same area. It is believed that its successful demonstration involves the application of the percentage principle of control on much more extensive areas and at less cost than is possible under the methods which have been in use on other projects.

This new system of combatting infestation has been given a preliminary trial on the Sequoia National Park in 1919, where summer work was carried out on a tract of about 7,000 acres. Solar heat was used instead of fire as a method of destroying broods in infested bark and the trap trees were also used to localize the infestation. The results from these methods apparently warrant their further tests on a project like the San Joaquin area.

It should be considered, however, that the system involves many new features, and that the final technique of applying the trap

tree method to the best advantage is still to be developed.

STATUS OF 1920 WORK.

Spring Work.

At this date the work on over-wintering infestation has been practically completed. A supplementary report giving detailed data for spring work is now in course of preparation. The following is the status of this initial phase of the project.

PRELIMINARY SURVEY -- completed for the entire area included by control work. Remainder of area to be completed in June.

CONTROL WORK ON OVER-WINTERING INFESTATION.

This work has been carried on over about 104,000 acres of the 130,000 selected for control work. On the remaining 26,000 acres the infestation was at such a low point that it was considered that only summer maintenance work would be necessary.

Approximately 366 trees with a volume of 700,000 ft. B.M. were treated at a cost of \$5,500.00. This represents about 65% of the total infestation on the area.

No further spring work will be recommended during the continuance of the project unless a very sudden epidemic increase develops.

Summer Maintenance Work.

PERIOD OF WORK

Work will be started about June 1st, and will be continued until October 15.

METHOD

The entire control area of 130,000 acres will be divided

into two districts for the administration of this work. The North-fork district will include all of the territory from the head of Crane Valley to the Rock Creek-Shake Flat divide--about 80,000 acres. The Chiquito District will include that part of the pine acreage of the basin within the drainage of Chiquito, Jackass, Kaiser and Daulton Creeks, about 50,000 acres.

A crew of two men will be assigned to each district. Each crew will work as a unit, equipped with portable camp outfits, so as to move camp frequently as the work develops. The general plan of carrying out this work is as follows:

June 15 to July 30:

First working over of district: Standing infested trees will be treated; windfalls to be located and treated; a limited number of trap trees to be felled at convenient points, depending upon location and amount of existing infestation.

July 31 to September 10:

Second working over of District: Trap trees previously felled to be treated; standing infested trees to be treated when accessible; additional trap trees to be felled if conditions warrant.

September 11 to October 15:

Final working over of District for season: All traps and standing trees to be treated.

The selection of trees for traps presents a particular problem. It is evident that trap trees cannot be felled promiscuously without due regard to both silvicultural features and the amount of infestation involved. The following points will be considered:

CHARACTER OF TRAP TREES:

Mainly trees whose removal will be of benefit to the forest--aside from windfalls, trees felled for traps will be: trees infested in tops; heavily mistle-toe infested; lightning injured; diseased; suppressed; decadent or otherwise injured; heavily fire-scarred at butt.

LOCATION AND SPACING OF TRAPS:

At accessible points along roads and trails where they can be easily reached, and in positions where they can be treated to best advantage. The question as to whether traps should be grouped or spaced will be made a subject for investigations. The first traps will probably be single trees, spaced with fair regularity depending on the amount of infestation in the surrounding area.

NUMBER OF TRAP TREES:

This will depend upon the amount and character of the existing infestation. The most satisfactory proportion of trap to existing infestation is still to be worked out on a quantitative basis.

TREATMENT OF TRAPS:

Previous work has indicated that traps take on the heaviest broods of *Dendroctonus* beetles when they are felled during the months of June, July and August--attack occurs within ten days after felling and the bark loosens so that it can be readily peeled in about 4 weeks after attack. When feasible, trap trees will be bedded so that as much of the main trunk as possible will lie clear of the ground. Bark will be peeled and placed, inside surface upward, in positions where it will receive the maximum amount of sunlight during the heat of the day.

Burning of limbs and tops will not be feasible during the summer period, altho this has been a regular feature of the spring work. In summer work, limbs will be lopped and scattered.

PERSONNEL:

The administration of the work will be under the direction of Forest Supervisor M.A. Benedict, who will select the men to be employed. The summer work, like the spring work which has been completed, will be carried out cooperatively with the representative of the Bureau of Entomology stationed at Northfork. The following men have been tentatively selected:

Northfork Crew: Albert Wagner, Entomological Ranger.
 Arthur Henry, Laborer.

Chiquito Crew: Henry Dietrich, Guard (Trained entomologist).
 E.H. Mortensen, Laborer.

FIRE FIGHTING

Each crew will have within reach a set of fire tools and will be ready at all times to respond to calls for fire-fighting. The crew will report, when near telephone, their daily location to the District Ranger.

ESTIMATED COST OF SUMMER WORK

The total costs of carrying out the summer maintenance work are estimated at about \$3,000.00 and this sum is available. About \$700.00 will be expended up to June 30. The protection will be applied to the entire area. This cost may be compared to that of 1917, when \$3,403.00 was expended in treating about 12% of the area.

In order to make clear the reasons for recommending the change from established control methods to that of summer maintenance, the following disadvantages may be stated as applying to previous control work, together with the features of the maintenance system which it is believed will overcome them.

1. Epidemics are usually not detected until near their maximum. Funds must then be recommended and a project can seldom be organized and put into operation without the delay of at least one season. Under the maintenance method it may be possible to detect and also attack epidemics in their early stages.
2. Period of winter and spring work is short, being limited to the months of March, April and May. This short period makes it difficult to secure efficient labor--over-head charges are high, or else supervision is inefficient. On the other hand, maintenance work may be extended season long, making it possible to secure trained men.
3. Winter or spring work is often interfered with by periods of unfavorable weather; this delays work and adds to the cost. Weather conditions are assured for the summer period. The only delays in the work which can be foreseen will be caused by fire-fighting emergencies.
4. During the winter and spring period many over-wintering trees are missed by control crews because of green foliage. During the hot weather of summer infested trees fade much more promptly after attack. Only trees attacked late in fall will hold green foliage any length of time.

length of time.

5. During summer season attacks occur in many large mature trees of high merchantable value. If this attack is attracted to trap trees of inferior quality, the amount of valuable timber lost will be considerably reduced.

6. Isolated trees which are difficult to reach, add greatly to the cost of control work. By the use of traps it should be possible to treat a considerable percentage of the infestation in accessible places.

7. Tight bark occurs on many trees which are treated during the winter and spring period, which makes peeling the most expensive part of the entire operation. Under the maintenance system it is possible to time the peeling operation so that the bark is removed after it loosens. In the Sequoia project this was found to be one of the greatest advantages of the summer work.

8. It is evident that the factors which influence the increase or decrease of the beetles are operative during the summer season. Where two complete generations occur as they do throughout the lower elevations of the San Joaquin project, it is possible to build up a vigorous epidemic during one season of activity. When only winter and spring work is carried on, the condition can not be checked until after the increase has occurred. By maintaining control work during the period of activity, it may be possible to check the epidemic before any serious increase has occurred.

PART III.

Future Work

PLANS FOR 1921.

With the close of the field work in 1920 there will be available data from each maintenance crew which will show the status of the infestation throughout the area, and the results of the season's work can be determined in a preliminary way. If the results show the reduction in infestation which can be reasonably expected, no further work with large crews is contemplated.

A limited amount of maintenance work for the season of 1921 is essential to the purpose of this project. It is considered, however, that the maximum expenditure for any season during the contemplated 5-year period will not exceed that estimated for 1920. It is possible, however, that the work may be reduced to a point where only one crew may be able to carry on the work for an entire season. However, as the work carries with it the advantage of offering much more adequate fire protection as well, it may be best to continue the organization along the lines of present estimates.

A contingent allotment of \$3,000.00 will be expected, therefore, to cover the cost of work from June 1 to October 15, 1921, and for the seasons of 1922, 1923 and 1924.

These costs provide for maintaining the crews in the field throughout the seasons. As part of the time will undoubtedly be devoted to fire-fighting and fire patrol, an adjustment should be made so as to properly apportion this cost between insect control and fire fighting.

More detailed allotment estimates will be submitted in the project report this fall. These can be made more intelligently after this summer's experience.

PART IV.

Insect Investigation on San Joaquin Area.

It is the purpose of the Bureau of Entomology to maintain a field station at Northfork, in order to conduct the investigative work essential to the study and demonstration of the new features of applying control involved in the trap tree and solar heat methods under the proposed system of permanent maintenance. At present, however, the greatly reduced appropriations for the fiscal year 1921 stand seriously in the way of properly equipping and financing such a station.

For the 1920 season, however, the Bureau will detail the services of at least two men, the greater part of whose time will be devoted to field assistance in carrying out the actual application of the methods on National Forest lands.

In addition to the problems of housing Bureau personnel, some sort of a temporary office and laboratory quarters are necessary. At least one small office room is needed because of the quantity of files, records, and reports which must be kept up, besides rough housing for the laboratory work; for the present the Forest Service has made available one of the Ranger Stations in the vicinity of Northfork.

Special investigations which will be carried on by the Bureau of Entomology from this station are as follows:

1. Determination of seasonal period during which solar heat can be used as a means of destroying broods. Previous tests have shown that this method does effectively kill broods of the Western Pine beetle in infested bark, but special attention should be given to a local study of:

- (a) No days exposure required.

- (b) Maximum and minimum temperatures involved, (both air and bark temperatures).

2. Checks upon efficiency of solar heat method in actual application in field. A check will be kept at intervals throughout the season upon bark exposed by the crews in the control work to

determine the percent of broods killed by this method. If it is found that the method is not producing effective results, it will be modified or discontinued.

3. Studies of trap-tree control, involving such problems as relative attractiveness of different classes of trap trees, proper spacing and location of traps with reference to existing infestation, etc.

4. Interrelation of Insects and Fires.

This project will be carried out in conjunction with the general control work altho not directly essential to it. It is considered one of the biggest problems of western forestry, and the intensive working of the San Joaquin area offers special advantages for this study.

5. Influence of slash upon increase or decrease of infestation:

This has for some time been considered one of the first problems in forest management, and upon its solution depends a number of regulations concerned with timber sales, cutting of rights of way, etc. It is planned to devote all of the attention possible to this on the San Joaquin area. Special opportunities for this study may be found in the check area south of the San Joaquin river where frequent cutting of rights of way, timber sales, etc., are in progress.

It is apparent that the investigative program includes a larger field than can be completed with the personnel available for 1920, but with the five-year period outlined and the prospects that additional personnel may be added, satisfactory progress seems assured.

PART V.

Cooperation.

The cooperation involved in the carrying of the entire San Joaquin project is mainly between the Bureau of Entomology and the Forest Service, and one large private owner, the White & Friant Lumber Company.

The Sierra National Forest controls at least 85% of the acreage of the entire area. This practically assures financial support for control work on nearly all of the area as long as funds can be made available.

The White & Friant Lumber Company have maintained control work on their own lands since 1915 and their cooperation seems assured so far as keeping up the work on their own lands is concerned.

The Bureau of Entomology is available for assistance in an advisory capacity both to public and private owners. The cooperative relations between the Bureau and the Forest Service will be those specified in the recent executive memorandum of the Secretary. All cooperative matters pertaining directly to the administration of the project will be taken up directly between the Bureau's representative and the Forest Supervisor at Northfork. It is also desirable to keep the District Office in close touch with the project through correspondence, reports and field trips. No important change in method or scope of work will be made locally without consulting the District Forester.

PART VI.

Compilation and Interpretation of Data.

As the amount and character of the work which is to be carried out each season must depend upon developments, careful compilation of data and periodic reports are essential as a basis for recommendations. The Bureau of Entomology will take the responsibility for keeping seasonal records of the following;

1. D.B.H. and volume of all trees on area killed by insects.
2. Tabulated records of all trees treated, whether standing trees or traps, and method of treatment.
3. Base map (2 in. scale) showing distribution and location of infested and treated trees.
4. Approximate cost of work by districts and methods employed. An annual report will be due at the close of each season summarizing all available data, and containing recommendation for the succeeding year. Copies of this report will be made available to the Forest Supervisor, the District Forester and the Bureau of Entomology.

As this project was recommended upon the initiation of the Ashland conference, a review of the work at this annual meeting is very desirable. However, the possibility of holding this inter-bureau, inter-district meeting in 1920 seems doubtful, and the main review and conclusions to be drawn from the 1920 work will have to be made by representatives of the Bureau of Entomology and the personnel of District 5.

APPROVED:

Date

6/25/20

Date

6/24/20

Date

7/3/20

Date

6/25/20.

on

Forest Supervisor.

signed

Assistant Entomologist

title

District Forester.

Assistant District Forester.

PROJECT AREA

Legend

- Willow Creek
- Yellow Pine-
- Sugar Pine
- Type
- Unit Boundaries

